

THE NORMAL TEMPERATURE OF PORTO RICO, WEST INDIES.

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Porto Rico, in common with most of the islands of the Tropics lying within the limits of the trade winds, has a warm, but equable and comfortable climate. The small geographical extent of the island, the moderate elevation above sea level, and a constant wind, give to it a uniform temperature characteristic of marine climates. The island is about 100 miles long from east to west, with an average width of 40 miles, while the mean elevation is perhaps 600 feet to 800 feet above sea level. There is a narrow belt of lowland along the east and west coasts, and a broader belt along the north and the south coasts. The hills and mountains of the interior rise abruptly from the coastal plain to elevations varying from a few hundred to 3,500 feet. Of the 43 stations named in the accompanying table of average temperatures 20 are on the low coastal plain. The remaining stations have an average elevation of about 1,000 feet, of which 12 range in elevation between 1,000 feet and 2,500 feet.

shine is so much more marked than in higher latitudes. Disregard of this fact is apt to give rise to conflicting opinions regarding temperature conditions based upon personal impressions.

MEAN MONTHLY AND ANNUAL TEMPERATURES.

The simplest expression for the temperature of a region is its mean annual temperature for a series of years. The United States Weather Bureau generally derives this value from readings of the highest and lowest temperatures for every day of the year. The mean annual temperature for the island of Porto Rico as a whole is 76.3° , a comfortable and healthful temperature when accompanied, as it usually is in Porto Rico, by the fresh winds of the northeast trades, and a relatively high percentage of overcast skies. The stations on the coastal plain have a somewhat higher mean temperature, about

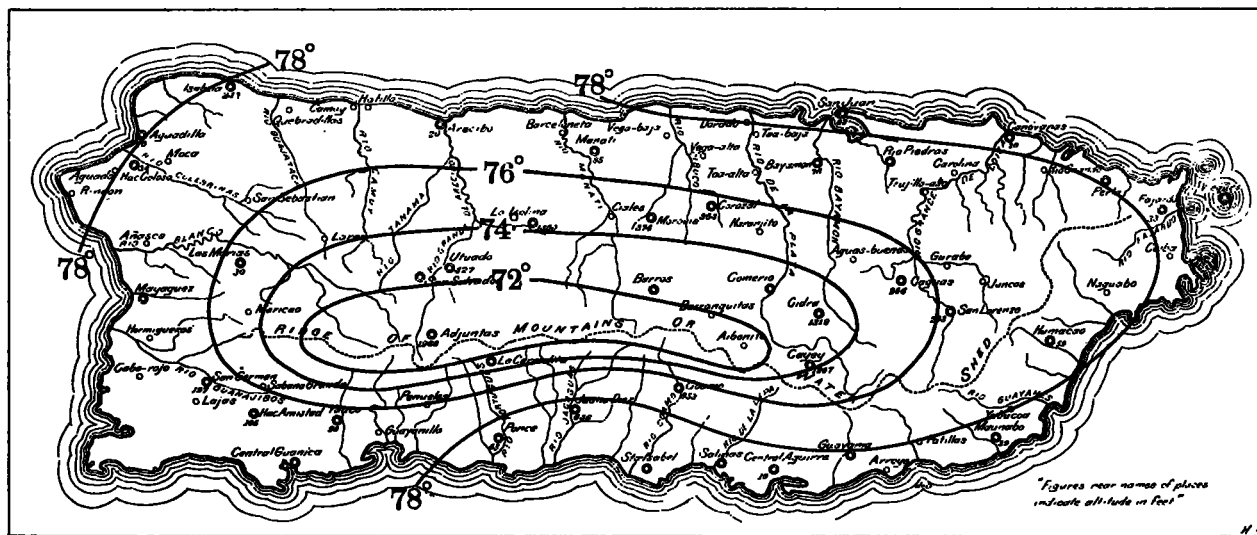


FIG. 1.—Mean annual temperature, Porto Rico.

Carefully made daily temperature observations extending over a period of five years in the Tropics, where changes are small, will yield an average annual value which is within a fraction of a degree of the true normal value. In Porto Rico the record of observations made under the auspices of the United States Weather Bureau began toward the close of the year 1898, and therefore covers a period of over 11 years. The average length of record per station is about 8 years; only a few of the stations enumerated in the accompanying table have a record of less than five years, while many of them have been in continuous operation since 1899.

In considering temperatures of the atmosphere it is essential to bear in mind that observations are always made in the shade; that is, the instruments are not exposed to the direct rays of the sun. This is a matter of special importance in discussing observations made in the Tropics, where the contrast between shade and sun-

78° along the north, west, and south coasts, and about 79° along the east coast. At inland stations the mean temperature is below 76° , varying from 76° to 72° , according to elevation above sea-level and other local conditions. The lowest temperatures are found, as usual, at the higher elevations, at stations from 2,000 to 2,500 feet above sea-level on the main divide, a range of mountains crossing Porto Rico from east to west a little south of the center of the island.

The average annual temperature of the island has varied but little from the normal during the past 12 years. In 1901, the warmest year of the period, the average was 1.3° above the normal, and in 1907, the coolest year, 0.9° below. The average temperature was above normal for the island as a whole from 1900 to 1903, inclusive, and normal or below from 1904 to 1910, inclusive. During the year 1910 the temperature continued below normal from January to November, inclusive.

The departures from year to year are indicated by the following figures:

1899, 0.5° below normal.
 1900, 0.9° above normal.
 1901, 1.3° above normal.
 1902, 0.5° above normal.
 1903, 0.4° above normal.
 1904, 0.3° below normal.
 1905, normal.
 1906, 0.2° below normal.
 1907, 0.9° below normal.
 1908, 0.2° below normal.
 1909, 0.3° below normal.
 1910, 0.8° below normal.

The average difference between the highest and lowest mean annual temperature for all stations is 2.3°; at coast stations it is 2°, and at inland stations 2.8°.

AVERAGE WINTER AND SUMMER TEMPERATURES.

To those accustomed to the strong climatic contrasts of middle latitudes the difference between winter and summer temperatures in Porto Rico seems small and insignificant. While the figures do not show a marked

is maintained between the mean temperature of coast stations and the higher inland stations throughout the year.

AFTERNOON AND EARLY MORNING TEMPERATURES.

While the mean daily temperature does not vary greatly from month to month, the differences between the afternoon and the early morning temperatures, or the daily range, as it is called, is comparatively large. At stations on the immediate coast, like San Juan, or on the smaller islands, like Culebra and Vieques, the diurnal range is influenced by surrounding ocean temperatures and is quite small, from 10° to 11°. At all inland stations, and practically all the towns of Porto Rico are 2 or more miles from the coast, the mean daily range is from 20° to 25°, according to local topography. The diurnal range is a matter of great importance and has much to do with the personal comfort experienced. While the afternoon temperatures are comparatively high, the night and early morning temperatures are low enough to insure comfortable nights throughout the year.

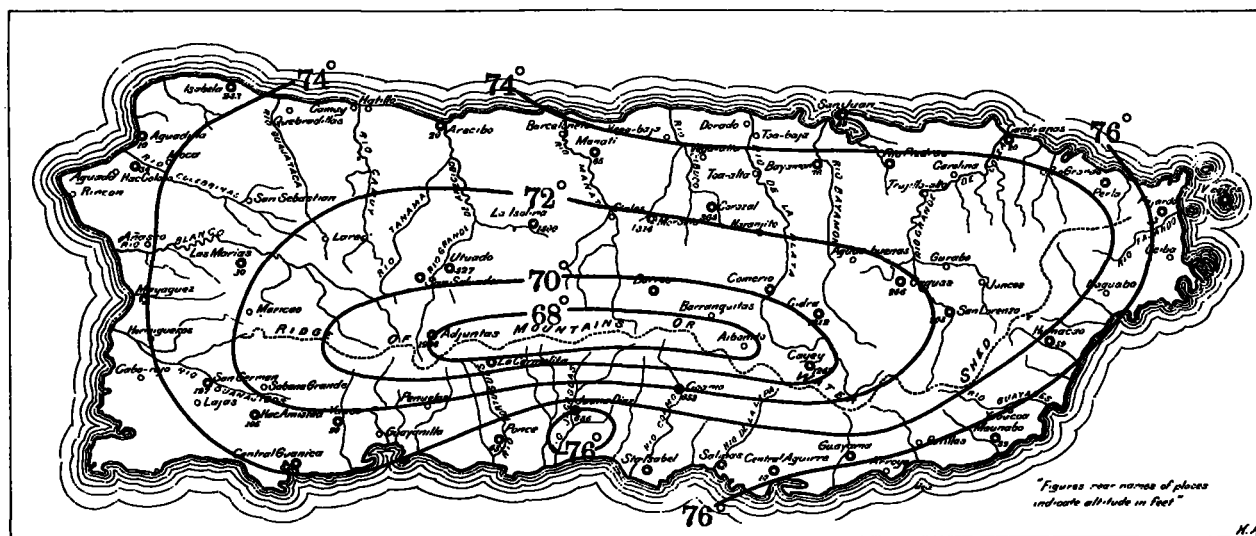


FIG. 2.—Mean January temperature, Porto Rico.

change, the contrast is nevertheless very decided, as registered by the factor of personal comfort. Residence in the Tropics seems to make one more sensitive to slight variations in temperature, and changes which come and go unnoticed farther north are matters of general comment in the Tropics.

January is, on the whole, the coolest month, with a general average of 73°, while the month of August is, on the whole, the warmest, with an average of 79°. The differences between the mean temperatures of July, August, September, and October are, however, very slight, and are probably due to differences in the rate of the wind movement, or to variations in the amount of cloudiness.

During the winter months the mean daily temperature is 75° to 76° along the immediate coast, decreasing to 74° over most of the coastal plain. At inland stations the mean temperature ranges between 72° and 68°, depending upon the elevation of the station above sea-level.

During the summer and early fall the mean temperature along the coast is 80° to 81°, although it frequently rises to 82° or 83° along the east coast. At elevated inland stations the mean summer temperature varies from 74° to 76°. A fairly constant difference of 6° to 8°

At stations along or near the coast the average daily maximum temperature is 87°, varying between 84° in winter and 89° in summer; the average daily minimum is 70°, varying between 66° in winter and 73° in summer. At inland stations the average daily maximum is 84°, with limits of 81° in winter and 87° in summer, and the average daily minimum is 65°, with limits of 61° in winter and 68° in summer.

Average daily maximum and minimum temperatures.

| | January. | | July. | | Year. | | Range. |
|-------------------------|----------|------|-------|------|-------|------|--------|
| | Max. | Min. | Max. | Min. | Max. | Min. | |
| <i>Coast stations.</i> | | | | | | | |
| San Juan..... | 80 | 70 | 86 | 75 | 84 | 73 | 11 |
| Fagardo..... | 85 | 68 | 88 | 75 | 86 | 72 | 14 |
| Ponce..... | 85 | 64 | 90 | 72 | 88 | 69 | 19 |
| Mayaguez..... | 86 | 62 | 90 | 68 | 88 | 65 | 23 |
| <i>Inland stations.</i> | | | | | | | |
| Aibonito..... | 76 | 58 | 84 | 68 | 81 | 62 | 19 |
| Barros..... | 77 | 58 | 86 | 67 | 82 | 63 | 19 |
| Cayey..... | 81 | 59 | 88 | 68 | 85 | 63 | 22 |
| Coamo..... | 86 | 62 | 91 | 70 | 89 | 66 | 23 |
| Lares..... | 83 | 58 | 90 | 64 | 87 | 62 | 25 |

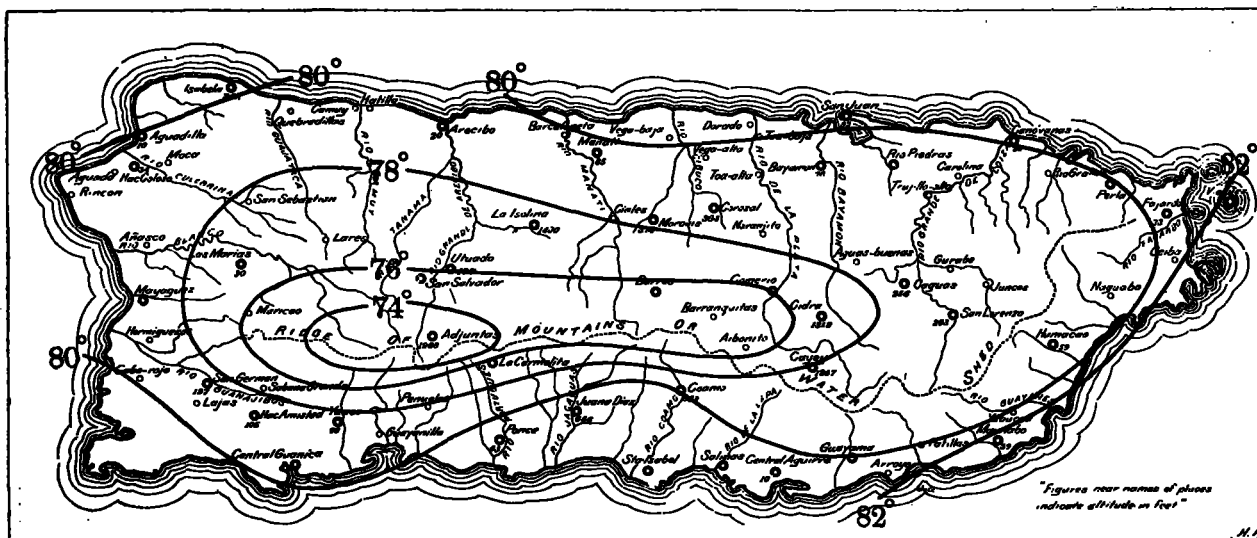


FIG. 3.—Mean July temperature, Porto Rico.

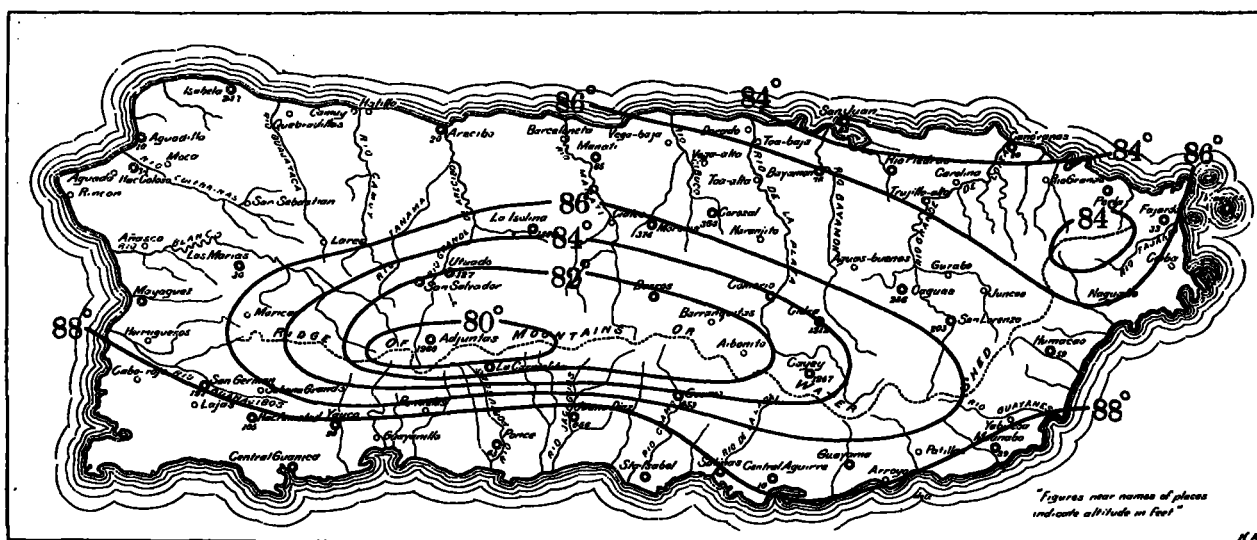


FIG. 4.—Mean daily maximum temperature (entire year), Porto Rico.

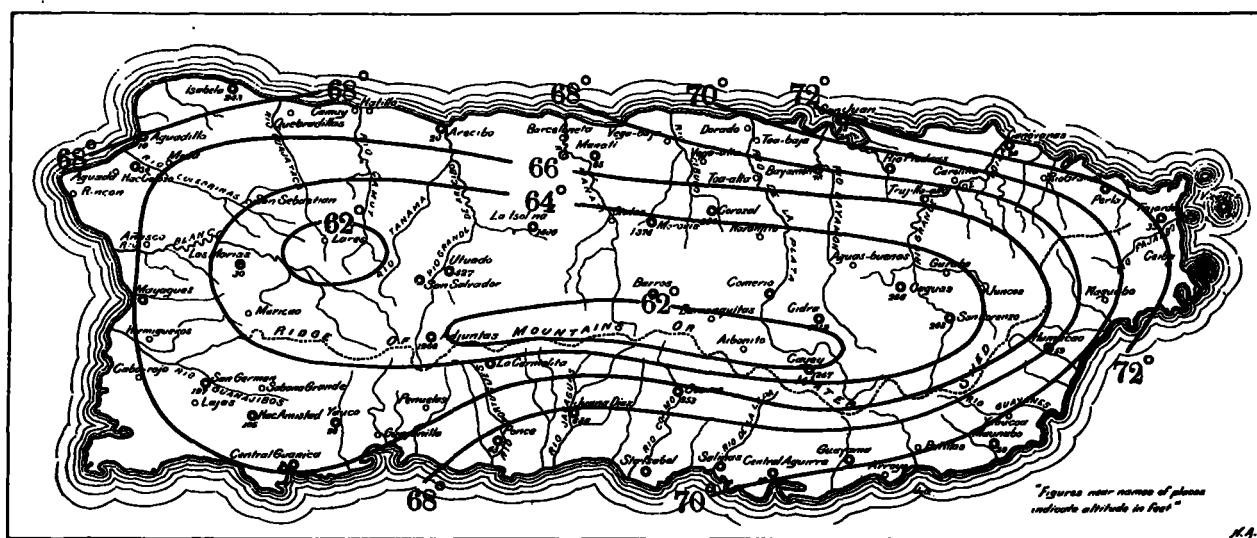


FIG. 5.—Mean daily minimum temperature (entire year), Porto Rico.

The temperatures quoted in the preceding paragraphs are *average* values and express the normal march of temperature from day to day and from month to month during a series of years and the normal variations during the course of the day. In the middle and higher latitudes, especially in regions far removed from the coast, such average values usually differ widely from the figures

representing actual temperatures experienced upon any particular day; in the lower latitudes, and especially upon the smaller islands, like Porto Rico, large departures from normal conditions are exceptional, and the figures representing average values do not differ greatly from those expressing the actual temperatures experienced from day to day.

TABLE I.—Data, mean monthly and annual temperatures, Porto Rico, W. I.

| | Stations. | Elevation in feet. | Number of years. | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Annual. |
|----|-----------------------------|--------------------|------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | | <i>Feet.</i> | <i>Years.</i> | | | | | | | | | | | | | |
| 1 | Adjuntas..... | 1,700 | 8 | 68.7 | 68.8 | 68.6 | 70.4 | 72.7 | 78.4 | 78.8 | 74.5 | 74.2 | 73.2 | 72.3 | 70.1 | 71.8 |
| 2 | Alto de la Bandera..... | 2,572 | 3 | 69.4 | 69.4 | 70.0 | 73.2 | 73.2 | 74.7 | 74.4 | 78.9 | 73.7 | 78.1 | 71.3 | 70.3 | 72.2 |
| 3 | Aguadilla (Coloso)..... | 34 | 10 | 74.2 | 73.8 | 73.9 | 76.0 | 77.8 | 78.7 | 79.0 | 79.0 | 79.2 | 78.6 | 76.6 | 75.1 | 76.9 |
| 4 | Aguirra..... | 10 | 10 | 76.2 | 75.9 | 75.9 | 78.0 | 80.0 | 80.4 | 80.6 | 81.4 | 81.3 | 80.7 | 79.5 | 77.2 | 79.0 |
| 5 | Albonito..... | 2,060 | 5 | 67.0 | 67.6 | 68.8 | 70.8 | 72.3 | 74.2 | 75.7 | 76.1 | 75.0 | 74.6 | 71.1 | 68.0 | 71.8 |
| 6 | Anasco..... | 25 | 4 | 75.5 | 74.6 | 75.2 | 76.2 | 78.3 | 78.8 | 78.8 | 78.9 | 78.6 | 79.0 | 77.8 | 75.3 | 77.3 |
| 7 | Arecibo (Town)..... | 20 | 7 | 73.9 | 73.7 | 74.5 | 75.9 | 78.2 | 79.3 | 79.4 | 79.7 | 79.7 | 78.9 | 77.3 | 74.5 | 77.1 |
| 8 | Bacupey (near Arecibo)..... | 1,000 | 4 | 70.4 | 70.4 | 71.1 | 72.6 | 74.5 | 75.6 | 77.1 | 77.4 | 76.7 | 76.4 | 74.6 | 72.6 | 74.0 |
| 9 | Barros..... | 2,000 | 7 | 68.5 | 68.6 | 69.3 | 71.2 | 73.5 | 75.6 | 76.2 | 76.3 | 74.5 | 73.8 | 72.3 | 70.4 | 72.5 |
| 10 | Bayamon..... | 75 | 11 | 73.7 | 74.1 | 74.5 | 76.1 | 77.9 | 78.5 | 78.9 | 79.3 | 79.6 | 78.9 | 77.8 | 75.2 | 77.0 |
| 11 | Caguas..... | 250 | 11 | 71.8 | 72.1 | 72.7 | 75.2 | 77.6 | 78.4 | 78.5 | 78.8 | 78.5 | 77.1 | 75.6 | 72.7 | 75.8 |
| 12 | Canovanas..... | 20 | 11 | 76.0 | 75.8 | 76.5 | 78.4 | 80.1 | 80.5 | 80.7 | 80.9 | 80.7 | 79.8 | 78.0 | 75.7 | 78.6 |
| 13 | Carmelita (1)..... | 1,550 | 7 | 70.8 | 71.0 | 70.8 | 71.9 | 72.5 | 74.5 | 75.4 | 75.9 | 75.1 | 74.8 | 73.9 | 72.4 | 73.3 |
| 14 | Cayey..... | 1,300 | 10 | 69.6 | 70.3 | 70.5 | 72.5 | 74.9 | 76.8 | 78.7 | 78.2 | 77.0 | 76.3 | 74.4 | 71.8 | 74.3 |
| 15 | Cidra..... | 1,300 | 10 | 70.0 | 71.1 | 70.6 | 72.9 | 74.4 | 74.8 | 76.1 | 76.4 | 78.4 | 74.9 | 73.9 | 71.0 | 73.5 |
| 16 | Coamo..... | 850 | 7 | 73.4 | 74.4 | 75.4 | 76.8 | 77.4 | 78.6 | 80.5 | 81.1 | 79.5 | 79.0 | 77.9 | 75.9 | 77.5 |
| 17 | Comerio..... | 600 | 4 | 71.4 | 71.1 | 70.9 | 74.0 | 77.6 | 77.6 | 78.2 | 78.3 | 78.5 | 77.6 | 75.2 | 73.2 | 75.3 |
| 18 | Corozal..... | 600 | 11 | 72.7 | 73.4 | 72.9 | 75.0 | 76.9 | 78.0 | 78.5 | 78.7 | 79.1 | 78.6 | 76.9 | 74.3 | 76.3 |
| 19 | Culebra..... | 50 | 3 | 76.1 | 75.8 | 77.4 | 77.7 | 79.6 | 81.0 | 81.2 | 81.3 | 81.4 | 80.6 | 78.9 | 77.1 | 79.0 |
| 20 | Fajardo..... | 15 | 11 | 77.0 | 76.6 | 76.8 | 78.4 | 80.4 | 80.9 | 81.6 | 82.3 | 81.4 | 80.7 | 79.6 | 77.2 | 79.4 |
| 21 | Guanica..... | 50 | 8 | 73.8 | 74.5 | 75.3 | 76.2 | 77.8 | 79.9 | 79.0 | 79.5 | 79.6 | 78.8 | 76.9 | 74.9 | 77.2 |
| 22 | Humacao..... | 60 | 4 | 73.6 | 72.6 | 74.2 | 75.6 | 78.0 | 78.8 | 79.2 | 79.5 | 79.2 | 78.5 | 76.9 | 74.3 | 76.6 |
| 23 | Isabela..... | 250 | 11 | 75.2 | 75.2 | 75.5 | 76.9 | 78.2 | 79.4 | 80.4 | 80.2 | 79.8 | 79.3 | 78.4 | 76.3 | 77.9 |
| 24 | Isolina..... | 1,400 | 11 | 71.2 | 71.8 | 71.5 | 73.2 | 74.9 | 76.5 | 77.2 | 77.3 | 76.8 | 75.9 | 74.8 | 72.1 | 74.4 |
| 25 | Juana Diaz..... | 200 | 10 | 76.1 | 76.0 | 76.9 | 78.0 | 78.8 | 79.9 | 80.9 | 80.9 | 80.9 | 80.0 | 79.0 | 77.7 | 78.8 |
| 26 | Lajas..... | 105 | 3 | 74.0 | 76.5 | 75.8 | 76.6 | 78.5 | 78.8 | 79.6 | 79.2 | 79.0 | 77.8 | 75.9 | 73.9 | 77.1 |
| 27 | Lares..... | 1,425 | 7 | 70.8 | 70.9 | 71.8 | 73.4 | 75.3 | 76.6 | 77.0 | 77.4 | 76.7 | 76.2 | 74.7 | 71.8 | 74.4 |
| 28 | Las Marias..... | 1,000 | 9 | 72.5 | 72.8 | 72.8 | 73.8 | 75.7 | 76.9 | 77.3 | 77.7 | 77.3 | 76.8 | 75.8 | 73.3 | 75.2 |
| 29 | Laquillo (1)..... | 460 | 8 | 73.8 | 74.4 | 74.8 | 76.9 | 79.1 | 79.3 | 79.6 | 80.6 | 80.0 | 78.9 | 77.3 | 75.6 | 77.5 |
| 30 | Manati..... | 85 | 11 | 73.8 | 74.4 | 74.7 | 76.4 | 78.4 | 79.6 | 80.2 | 80.7 | 80.1 | 79.1 | 77.2 | 74.7 | 77.4 |
| 31 | Maricao..... | 1,400 | 3 | 70.7 | 69.2 | 69.8 | 70.6 | 72.2 | 73.6 | 74.3 | 75.1 | 74.9 | 74.7 | 73.0 | 70.9 | 72.4 |
| 32 | Maunabo..... | 40 | 10 | 76.6 | 76.7 | 77.1 | 79.0 | 80.2 | 81.7 | 82.2 | 88.0 | 81.9 | 81.2 | 79.7 | 77.9 | 79.7 |
| 33 | Mayaguez..... | 20 | 10 | 74.4 | 74.7 | 75.1 | 76.4 | 78.1 | 78.9 | 79.2 | 79.5 | 79.6 | 79.2 | 77.7 | 75.8 | 77.4 |
| 34 | Morovis..... | 375 | 8 | 72.7 | 72.6 | 72.4 | 75.4 | 77.0 | 77.8 | 78.1 | 78.7 | 78.1 | 77.5 | 76.2 | 72.8 | 75.8 |
| 35 | Ponce..... | 50 | 10 | 75.1 | 75.0 | 75.8 | 77.5 | 79.1 | 80.2 | 80.3 | 81.2 | 80.7 | 80.1 | 78.8 | 76.5 | 78.3 |
| 36 | Rio Blanco..... | 250 | 6 | 73.6 | 74.2 | 74.7 | 76.2 | 77.7 | 78.6 | 79.4 | 79.5 | 79.1 | 78.6 | 77.3 | 75.2 | 77.0 |
| 37 | San German..... | 200 | 9 | 73.9 | 74.4 | 74.5 | 75.8 | 77.6 | 78.8 | 80.0 | 80.1 | 80.2 | 79.5 | 77.9 | 75.7 | 77.3 |
| 38 | San Juan..... | 82 | 11 | 75.3 | 75.4 | 75.5 | 77.2 | 78.4 | 80.0 | 80.2 | 80.6 | 80.7 | 80.1 | 78.4 | 76.4 | 78.2 |
| 39 | San Lorenzo..... | 200 | 8 | 72.9 | 72.7 | 73.6 | 76.2 | 78.0 | 78.8 | 78.8 | 79.4 | 79.0 | 78.0 | 76.7 | 73.7 | 76.5 |
| 40 | Santa Isabel..... | 23 | 9 | 74.7 | 74.9 | 75.6 | 77.3 | 78.8 | 79.9 | 80.4 | 81.0 | 80.5 | 80.0 | 78.3 | 75.7 | 78.1 |
| 41 | Utua (San Salvador)..... | 1,500 | 9 | 70.4 | 70.2 | 70.3 | 71.9 | 73.9 | 75.2 | 75.5 | 75.7 | 75.4 | 75.0 | 73.2 | 70.9 | 73.1 |
| 42 | Vieques Island..... | 45 | 11 | 76.1 | 76.3 | 76.9 | 77.8 | 79.7 | 80.1 | 81.1 | 81.3 | 81.0 | 80.7 | 78.9 | 76.8 | 78.8 |
| 43 | Yanco..... | 200 | 10 | 72.8 | 74.0 | 74.4 | 76.7 | 79.2 | 80.0 | 79.5 | 80.1 | 79.9 | 79.1 | 77.3 | 75.2 | 77.4 |
| | Means..... | | | 78.0 | 73.2 | 73.6 | 75.3 | 77.1 | 78.1 | 78.7 | 79.0 | 78.5 | 77.9 | 76.4 | 74.2 | 76.3 |

NOTE.—Maxima and minima are in bold face figures.